REMARKS

Claim Rejections – Obviousness-Type Double Patenting

Timely filed terminal disclaimers in compliance with 37 CFR 1.321(c) or 1.321(d) are being submitted herewith to advance prosecution and overcome the provisional obviousness-type double patenting rejections based on copending Application No. 10/823,443, Application No. 10/822,945, Application No. 10/823,446, and Application No. 10/823,453. The obviousness-type double patenting rejection based on Application No. 10/822,450, however, is believed to be in error as this application is directed towards a totally unrelated technology (a mobile telephone alarm system). It appears the Examiner may have intended to refer instead to Application No. 10/822,940, which has original composition and article claims 1-44 (as referenced in the rejection), and which corresponds to Attorney Docket number 87428 cited in the Information Disclosure statement filed with the instant application. Accordingly, to advance prosecution, a terminal disclaimer with respect to such additional copending application 10/822,940 is also submitted herewith.

Claim Rejections - 35 USC § 102

Claims 1-6, 8-36, and 39-48 are rejected under 35 U.S.C. 102(a) as being anticipated by WO 03/089113 (WO' 113). The Examiner states WO' 113 teach the inorganic nanoparticles as claimed, including inorganic metal oxides, having a particle size and surface area that fall within the instantly claimed ranges wherein the nanoparticles are derivatized such that they have functional groups as claimed (see pages 27-28), which would inherently have a stability constant with iron (III) as in the instant invention, and are useful in a variety of applications involving separations, particularly separation of biological materials, wherein the particles may be immobilized in a polymer layer on an article as claimed (Page 13, lines 31-Page 23, line 24; Claims 1, 2, 18, 75, 80 and 83; Figures 1, 2a, 2b; and Examples 4 and 7.) This rejection is respectfully traversed.

The composition of matter described and claimed in the instant application is distinct from that of Hughes et al. (WO'113) in that the claimed average particle size, and corresponding surface areas, are not taught or suggested by WO'113. On page 19, WO'113 states "The minerals in these mixtures may be

ground to a desirable particle size, e.g., 80 –325 mesh or smaller". The "mesh scale" is normally used for particles that are sieved through a series of screens of a given hole size (or mesh). Particles larger than the hole size are retained while smaller particle pass through the mesh (note: the larger the mesh rating the smaller the hole size, as the mesh number relates to the number of openings per unit length of the screen). A mesh size of 80 – 325 corresponds to a particle size range from about 180 μm (80 mesh) to 44 μm (325 mesh). These sizes when converted to nanometers (1 μm = 1000 nm) are <u>180,000 nm to 44,000 nm</u>, or about <u>1000 times larger than the particle sizes claimed in the present invention</u>. While WO'113 mentions that particles might be ground smaller than 325 mesh (i.e., 44,000 nm), it is extremely difficult to grind larger materials down to nanometer sizes as claimed, and WO'113 does not teach or otherwise disclose any reason (or appropriate technology) to do so to the present claimed size. Thus, the present invention, with an average inorganic nanoparticle size of less than 200 nm (or less than 100 nm, or less than 20 nm, or with specified percentages of particles being less than 200 nm or less than 50 nm as set forth in dependent claims) is <u>not</u> anticipated by WO'113. Similarly, the required specific surface areas of claims 18-21 and 43-46 are also not anticipated.

It is further noted that in addition to the claimed particle sizes and specific surface areas not being disclosed or otherwise suggested by WO'113, there also appears to be no support for the allegation that a barrier layer as required by claims 32-62 is anticipated by WO'113.

Claim Rejections - 35 USC § 103

Claims 7 and 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO' 113. The Examiner states that though WO' 113 does not teach that weight percent of the nanoparticles with respect to the polymer material as instantly claimed, one having ordinary skill in the art at the time of the invention would have been motivated to determine the optimum amount of nanoparticles to provide the desired separation or functional properties to the polymer based on a particular end use. Further, the Examiner states that though WO' 113 do not specifically teach the incorporation of the barrier polymers as claimed, it would have been obvious to one having ordinary skill in the art at the time of the invention to utilize any conventional polymer material utilized in the

art, such as those instantly claimed, and further to determine the optimum number of polymer layers or polymer material to provide based on a particular separation end use. This rejection is respectfully traversed.

The present claimed nanoparticle size range is an important factor regarding the instant invention for reasons supported on pages 7 – 8 (line 31 - 32, 0 - 18) of the application. Small particle size is essential for forming a transparent or invisible layer, which allows the particles of the present invention to be applied to consumer items, or other items without changing the appearance of that item. Further small particle size is essential for allowing for large surface area so that more sequestering agent can be loaded onto the particle surfaces. In particular, it is preferred that the nanoparticles have a very high surface area, since this provides more surface with which to covalently bind the metal-ion sequestraint, thus improving the capacity of the derivatized nanoparticles for binding metal-ions. Finally, small particle size is essential so that a high binder (polymer) to particle ratio (wt/wt) can be used. If the binder to particle ratio is too small (less than 1), much of the particles may be trapped at the surface of the polymer, and biologically relevant metal ions will be sequestered there. Micro-organisms such as bacteria may then successfully compete for the metal ions since they are in direct contact with them at the surface.

Regarding the rejection of claim 7, the Examiner's assertion that the skilled artisan would have been motivated to determine an optimum amount of nanoparticles to the polymer to provide the desired separation or functional properties "based on a particular end" use is not supported, as the Examiner has not identified any particular end use suggested by WO'113 that would result in an optimization so as to result in the present claimed invention, and as employing nanoparticles so as to enable relatively high particle surface areas and higher binder to particle ratios, and thereby avoiding the competition of micro-organisms for sequestered metal ions that may occur where larger particles are used with lower binder to particle ratios, is not taught or otherwise suggested by WO'113.

Regarding the rejection of claims 37-38, the Examiner's assertion that it would have been obvious to one having ordinary skill in the art at the time of the invention to utilize any conventional polymer material utilized in the art, such as those instantly claimed, as a barrier layer and further to determine the optimum number of polymer layers or polymer material to provide based on a

particular separation end use is not supported, as the Examiner has not identified any particular end use suggested by WO'113 that would suggest use of a barrier layer so as to result in the present claimed invention, and as employing a barrier layer not containing derivatized nanoparticles so as to prevent the competition of micro-organisms for sequestered metal ions that may otherwise occur at the surface of an article comprising such derivatized nanoparticles is not taught or otherwise suggested by WO'113.

The specification and arguments above support the conclusion that small nanoparticle size is important for obtaining an aesthetically appealing, very high capacity, and irreversible sequestering of biologically relevant ions. This is supported in the specifications on page 8, lines 14-17 of the application, where it states that for applications of the invention in which the concentrations of contaminant or targeted metal-ions in the environment is high, it is preferred that the nanoparticles have a particle size of less than 20 nm and a surface area of greater than 300 m^2/g. We point out here that the smallest particles actually mentioned in WO'113 using a sieving method (325 mesh or 44 um) corresponds to a specific surface area of only about 0.1 m^2/g. This would lead to a metal-ion capacity of 0.1/300, or less than one-thousandth of the current invention. A Table relating particle size to surface are is included below for convenience.

Table. Particle size and calculated specific surface areas for spherical silica particles.

Particle size (nm)	Particle size (microns)	Specific surface area (m^2/g)
10	0.01	290
20	0.02	143
50	0.05	57
100	0.1	29
200	0.2	14
1000	1.0	2.9
10,000	10	0.3
44,000	44	0.1